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I, KAY WARD, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PQ 2809 for a patent by PETER RAFFAELE and MICHAEL RAFFAELE filed on 14 September 1999.

WITNESS my hand this
Eleventh day of April 2000

KAY WARD
TEAM LEADER EXAMINATION
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AUSTRALIA
Patents Act 1990
PROVISIONAL SPECIFICATION
FOR A PROVISIONAL PATENT

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Invention Title: **Fluid Devices**

The following statement is a description of this invention

Fluid Devices

This invention relates to scotch yoke type fluid devices and in particular to scotch yoke type devices the subject of our earlier applications. Reference is made to earlier application numbers PP9306, PP9573, PQ0287, PQ0795, PQ2408,
5 PQ0895, PQ2205, PP9266, the contents of which are incorporated herein.

In those earlier applications we have disclosed devices in which piston motion is achieved by sliders mounted on big ends and in which two or more pistons may be mounted on a single slider but each of which moves along a separate path to each other.

- 10 We have found that because each piston is not directly connected to any other piston, there is a tendency for the pistons to rotate in the cylinders about an axis generally parallel the crank axis. This can lead to destructive failure of the device. We have found that providing guide means, extending parallel to the cylinder axis, prevents such rotation, and this has been disclosed in our earlier
15 applications. In these earlier applications the guide means disclosed lie above the swept volume of the crank shaft and big end. We have discovered that we can place the guide means so that at various parts of the cycle they extend into the volume swept by the crank and slider. This results in a more compact device.

In one broad form the invention provides a fluid device which includes:

- 20 a crank mechanism including a big end bearing which orbits about a main axis, the big end having a big end axis;
- connecting means rotatably mounted on the big end for rotation about the big end axis;
- 25 at least one piston mounted for reciprocal motion in a cylinder along a piston axis; the piston having first position guide means which engages engagement means on the connecting means;
- at least one second piston guide means for constraining the piston to move along the piston axis;
- 30 wherein, as the crank mechanism rotates, the at least or second piston guide means extends into the swept volume of the crank mechanism.

Preferably the second piston guide means is located within the axial cross-sectional area of the piston.

Preferably each piston has two second guide means and more preferably they are located symmetrically relative to the piston axis.

- 5 The invention shall be better understood from the following, non-limiting, description of a preferred embodiment of the invention and the drawings, in which.

Figure 1 is an end view of an embodiment of the invention at a first position during its cycle.

- 10 Figures 2 to 4 are end views of the embodiment of Figure 1 at different stages of its cycle.

Figure 5 shows a view of the embodiment taken perpendicular to one of the cylinder axes at a position corresponding to bottom dead centre for one of the pistons.

- 15 Figure 6 shows a view of the embodiment similar to that of Figure 5 but at top dead centre.

Figure 7 shows a perspective view of the embodiment.

Figure 8 shows an expanded view of part of Figure 7.

- Referring to the drawings there is shown a fluid device 10 having a crank 12
20 rotating about a crank axis 13 and two pistons 14 reciprocating in cylinders 16. The two pistons 14 are connected to the crank 12 via a single slider mechanism 18, which is rotatably mounted on the big end 20 of the crank. The big end 20 extends between webs 22. The slider 18 has two T-shaped tongues 24 which slidably engage in corresponding slots 26 in the pistons. As the crank rotates the
25 slider 18 slides relative to the pistons 14, which are caused to reciprocate in the cylinders.

- Extending downwards from the base area of each piston are two guide bars 28. These bars 28 extend on either side of the slider 18 and slot 26. In addition, each bar extends below the slot 26 toward the crank axis 13. Whilst two bars 28 per
30 piston are shown, it will be appreciated that only one or more than two bars per piston may be used. Where two or more bars are used it is not essential that they

be located symmetrically relative to the cylinder/piston axis; the bars may be positioned to one side of the slot 26 or asymmetrically on both sides.

A corresponding number of guides 30 are provided for the guide bars 28 and are attached or integral with the crank case. In the embodiment shown each guide 30
5 includes a U-shaped channel in which the respective guide bar 28 reciprocates.

As best seen in Figures 7 and 8 the big end 20 is supported by two webs 22. The guide bars 28 are positioned on the piston 14 to lie between the two webs 22 when viewed from the side. In addition, as best seen in Figures 1 to 4, when viewed on end, the guide bars 28 extend along the cylinder axis toward the crank
10 axis 13. Thus the provision of the guide bars does not require additional space in the crank case.

As the crank 12 rotates, the pistons 14 reciprocate in their pistons and, as seen in Figures 1 to 4, the guide bars move up and down with the pistons into and out of the volume swept by the big end.

15 At bottom dead centre the guide bars 28 may extend to be just clear of the sleeve 34 of the slider and so allow the guides 30 to lie as close to the swept volume of the crank shaft as possible. This allows for a compact configuration, with the distance between the piston crown 36 and crank axis 13 to be minimised.

It will be apparent that many modifications and variations may be made to the
20 embodiments described by those skilled in the art without departing from the spirit or scope of the invention.

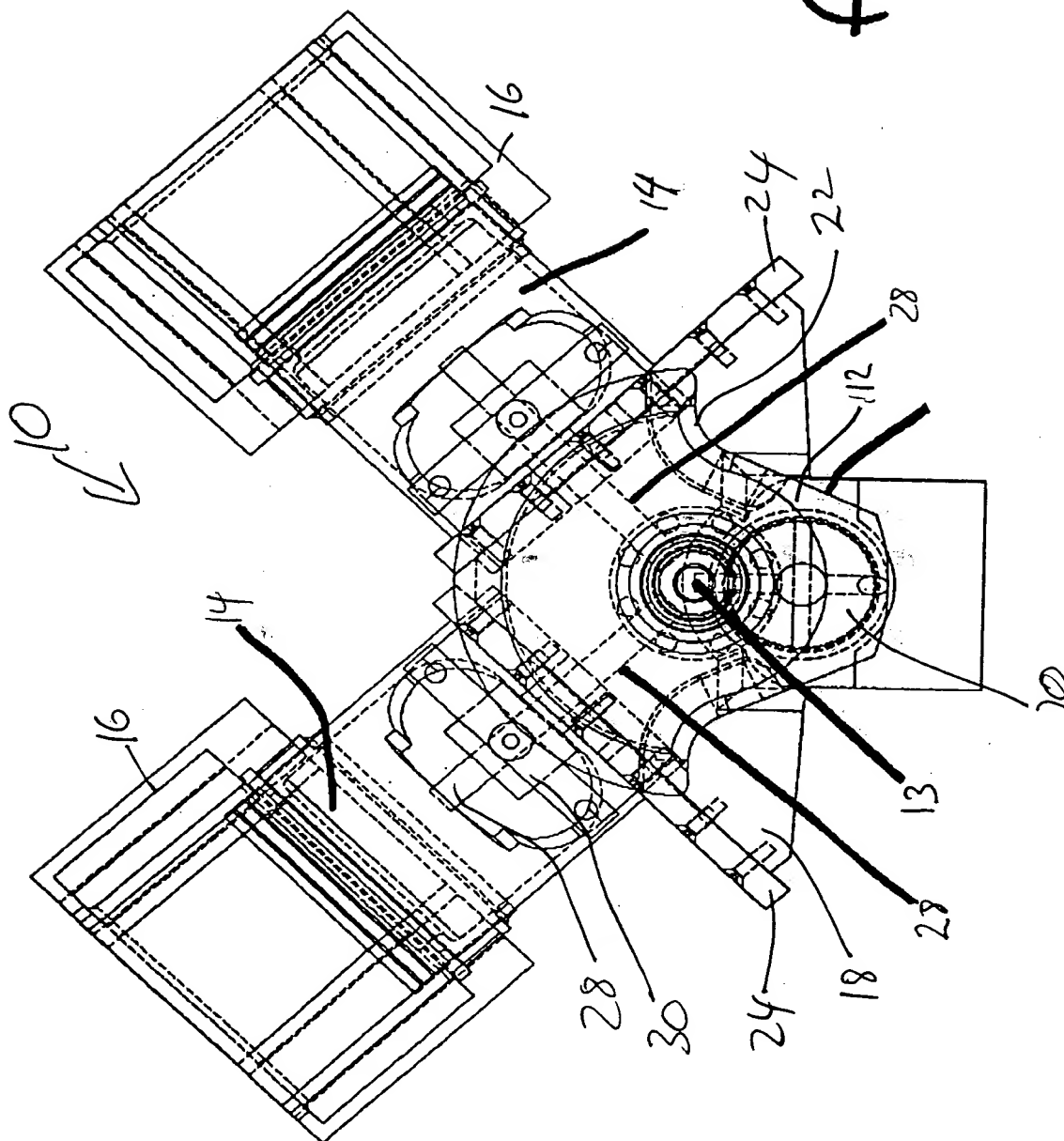
Dated this 10th day of September, 1999

Peter Robert Raffaele

By his Patent Attorneys

Chrysiliou Moore Martin

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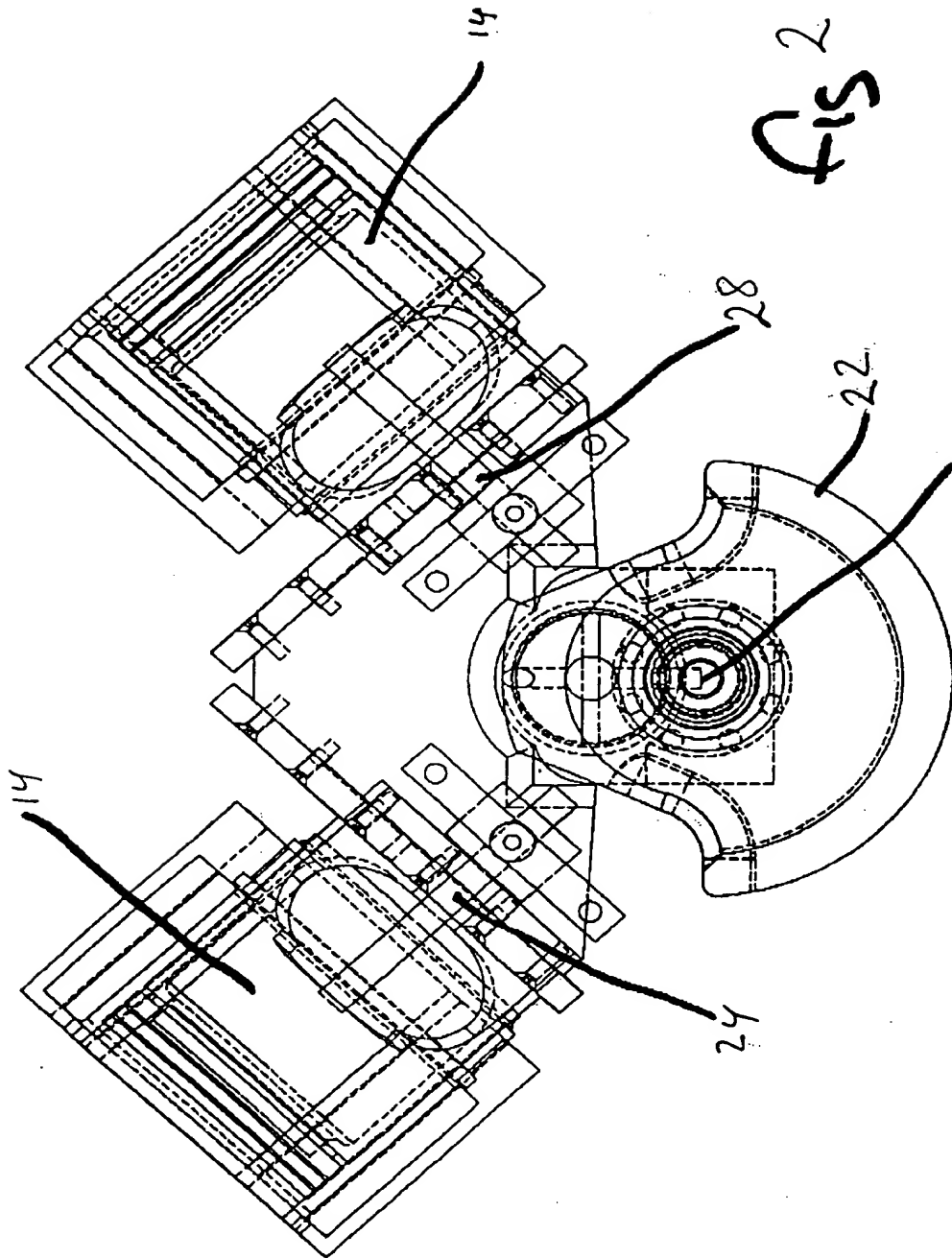
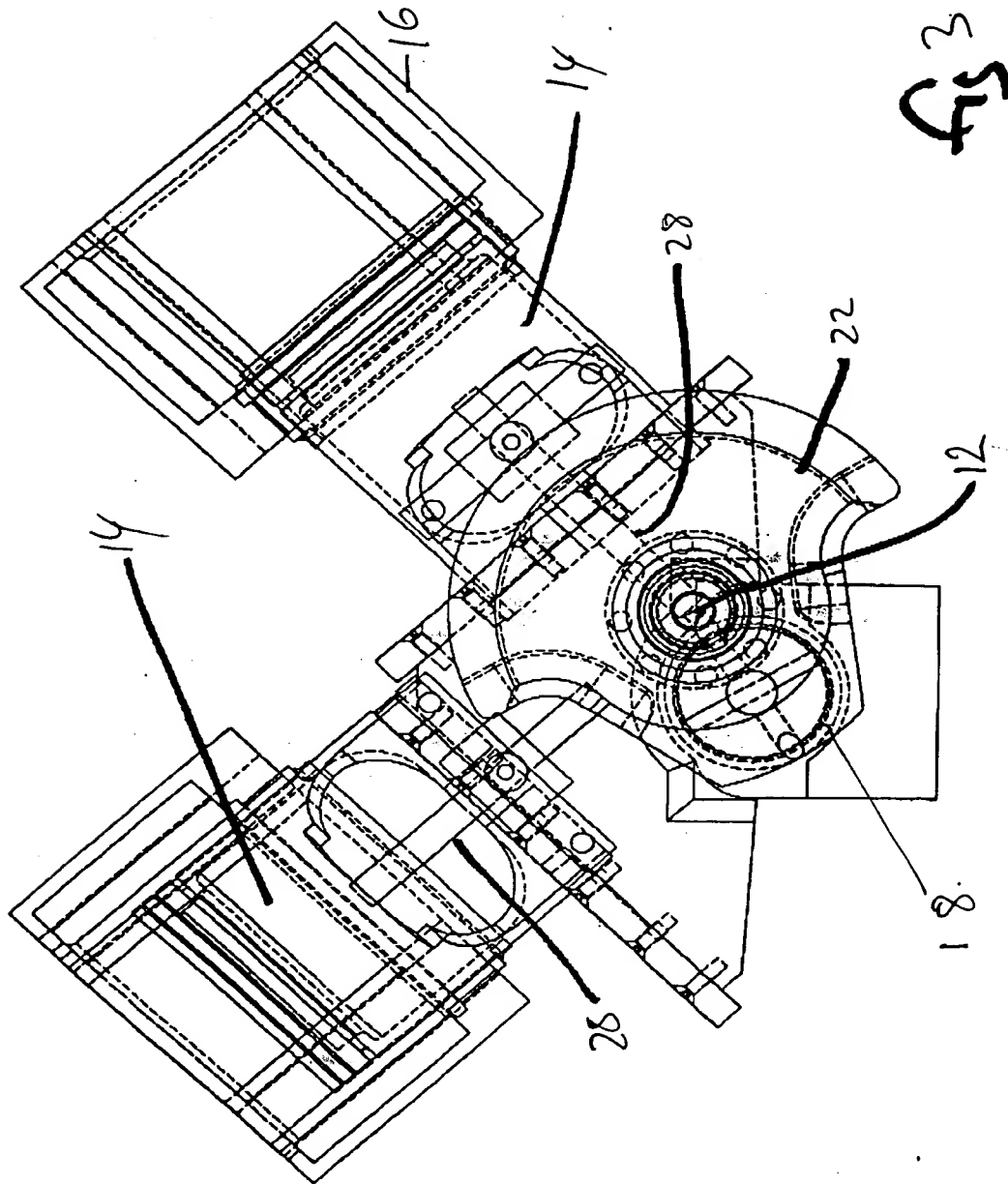
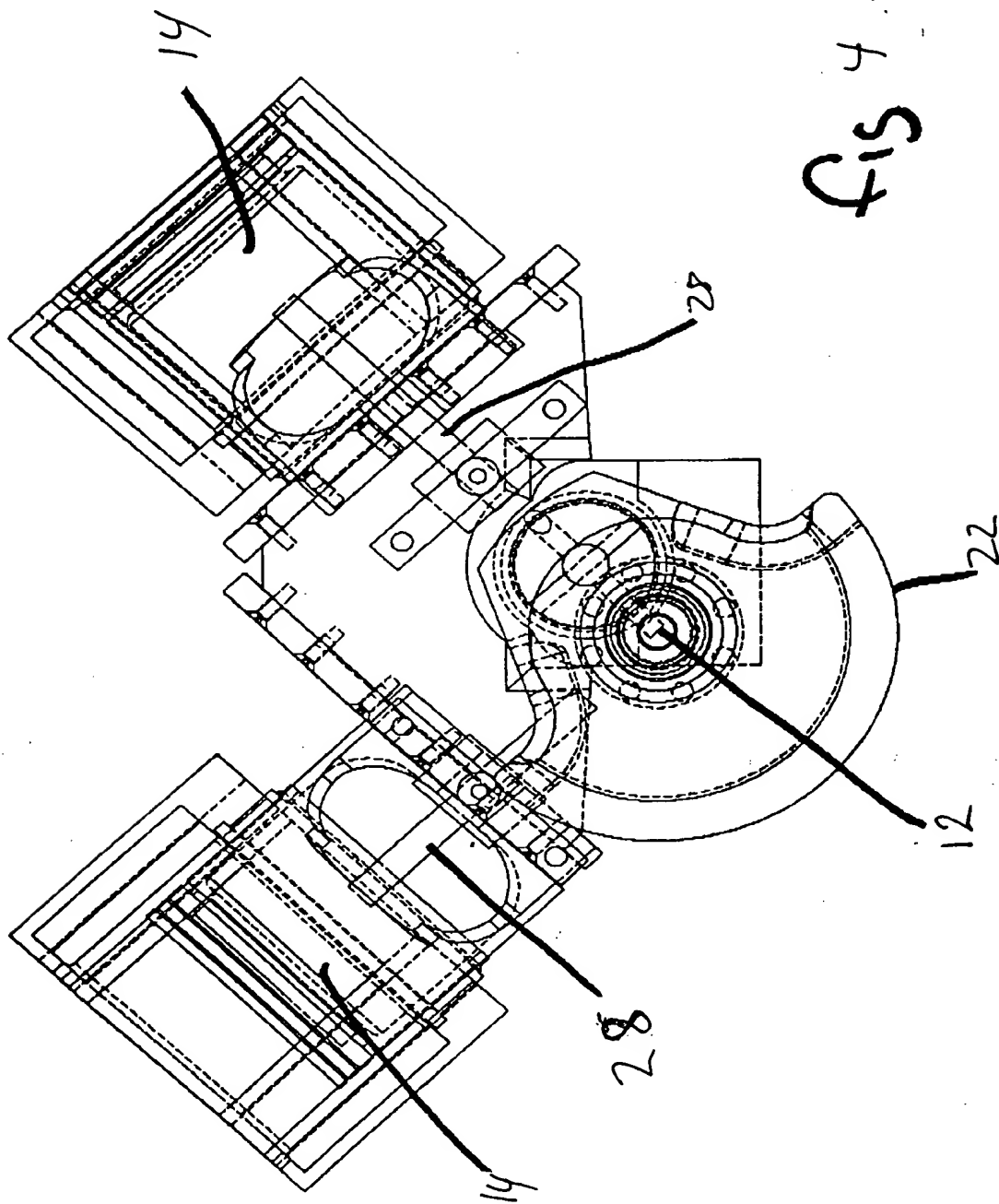


Fig 2





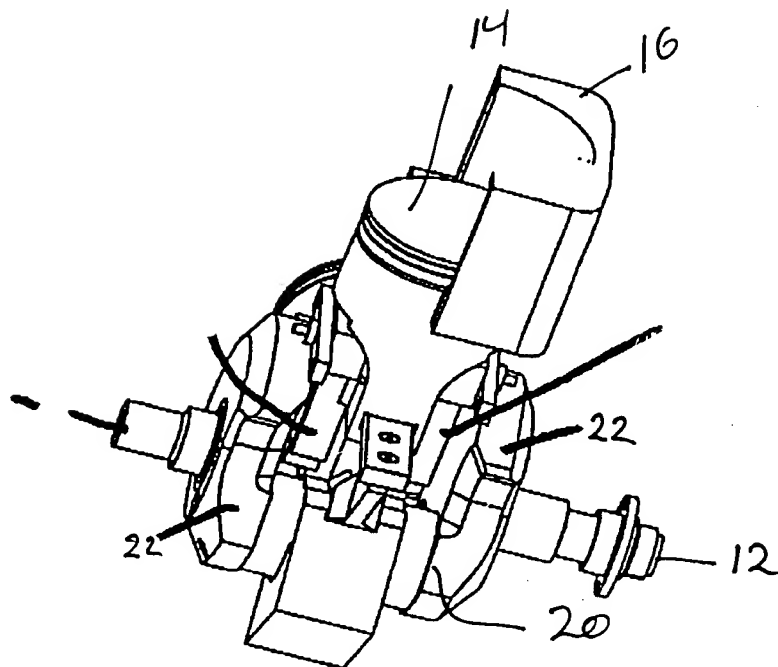


fig 5

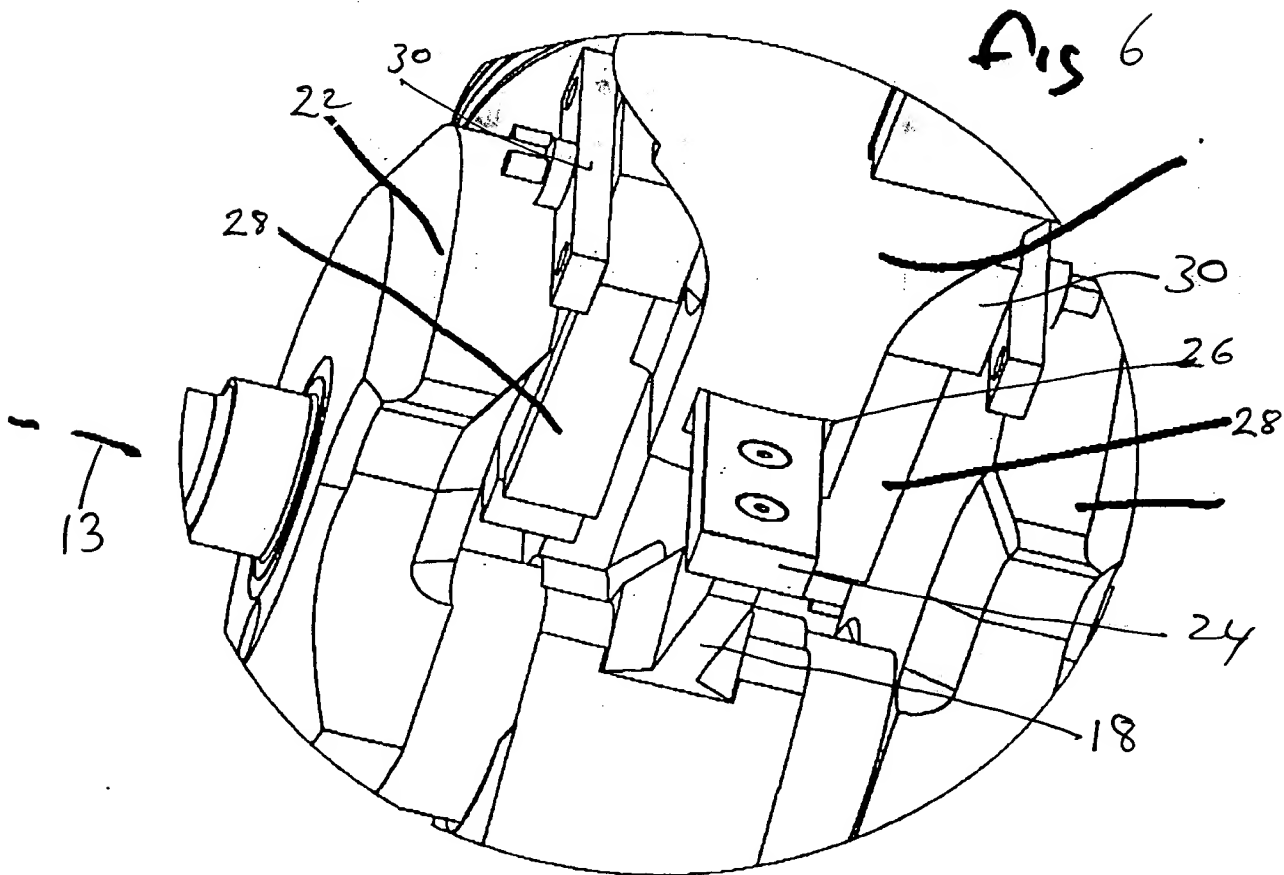


Fig 6

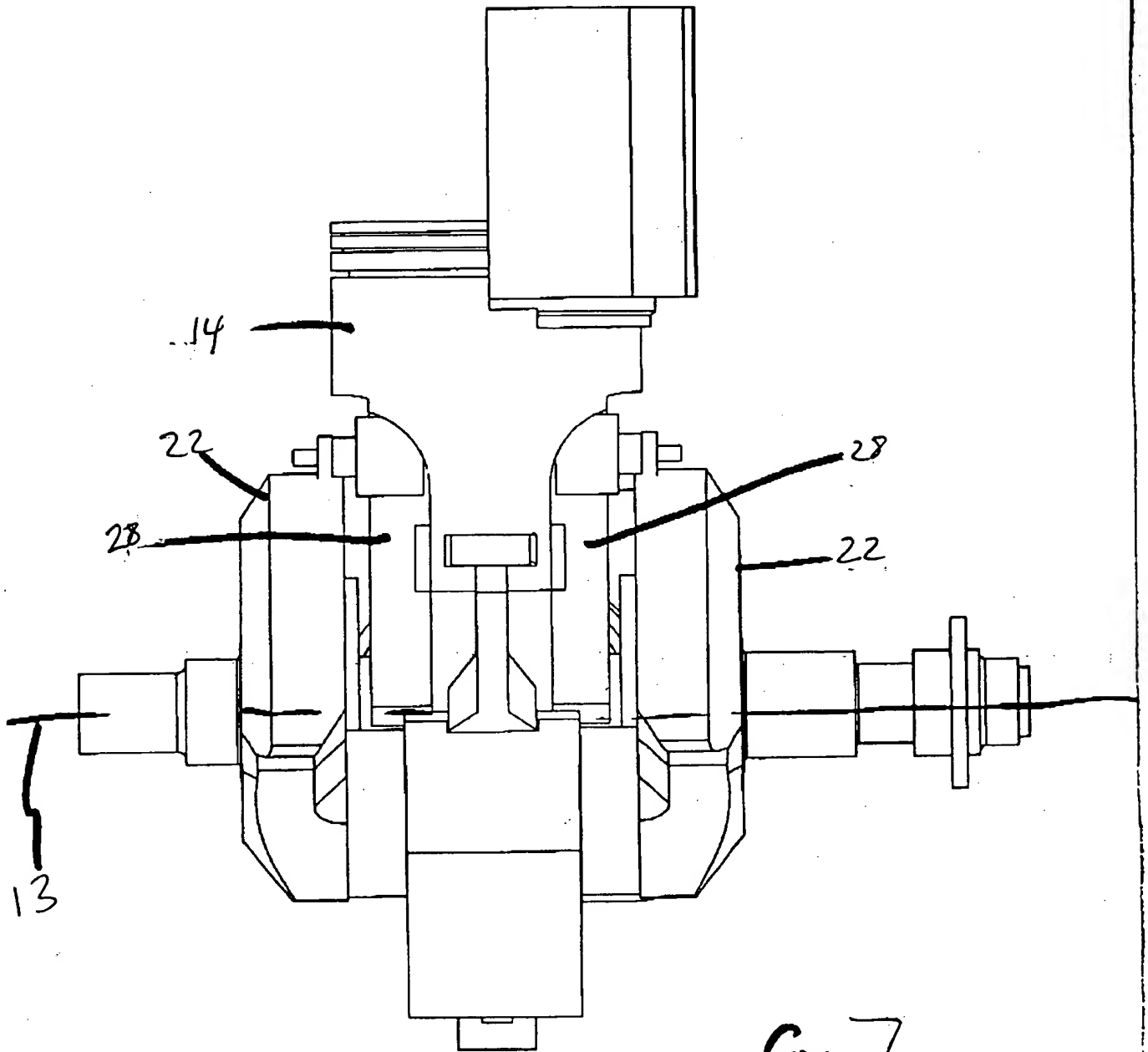


Fig 7

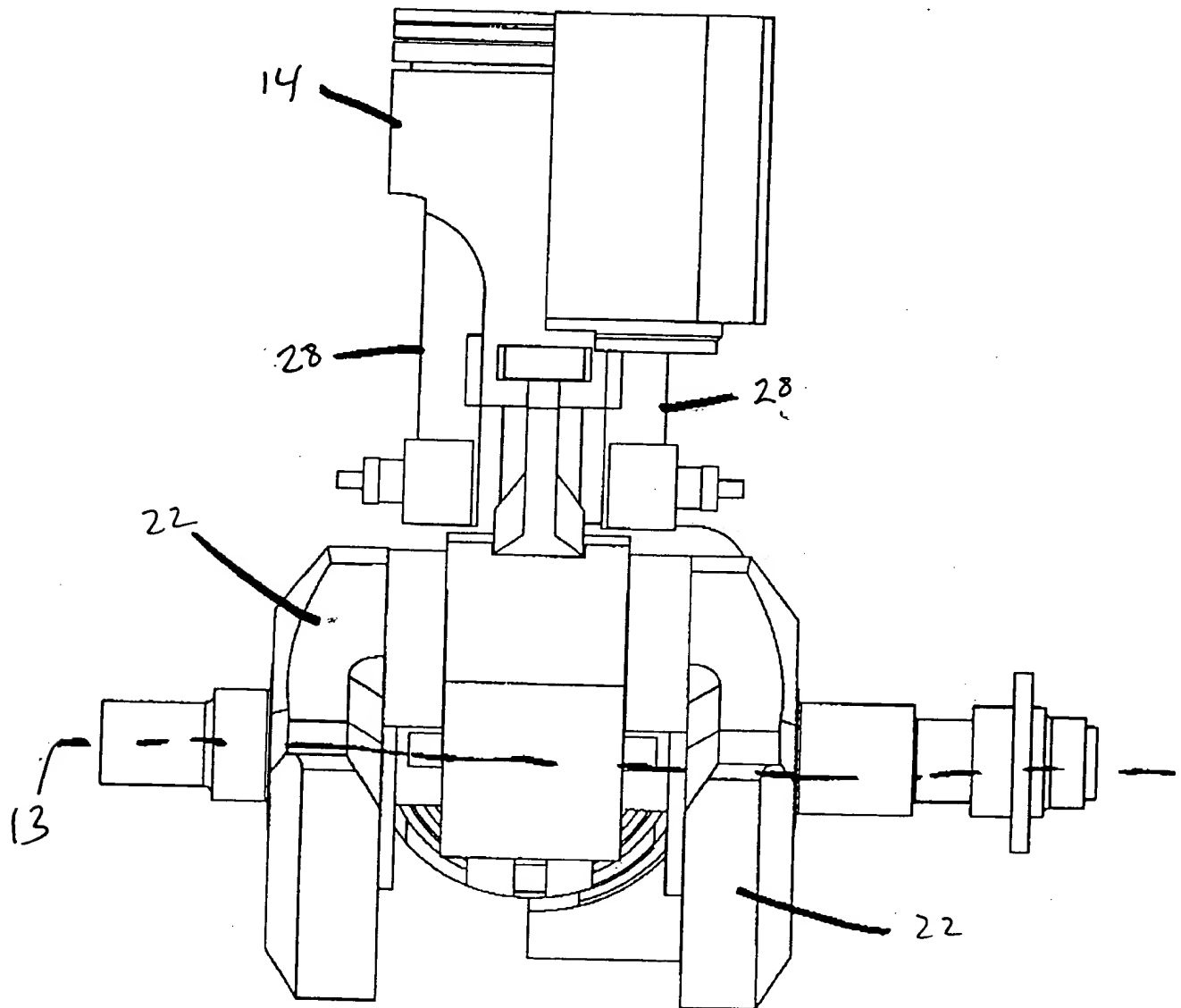


Fig 8